



Environmental Protection Department

Recommendations for Improving Waste-Generation Reporting for the Contract 48 Performance Measures

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September 30, 1998

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Executive Summary

This document is based on available waste-generation data from the Total Waste Management System (TWMS) database for calendar years 1994 through 1997. The purpose of the analysis is to identify the amount of time required for the data to be considered complete enough and available to the Pollution Prevention Group (PPG) at Lawrence Livermore National Laboratory to prepare accurate estimates for performance measures quarterly reports. The current reports use this incomplete data which forces PPG to make subsequent revisions to the reported data. An approach that can readily address and correct the problem is recommended.

In general terms, the completeness of TWMS data is a function of elapsed time. In this report, elapsed time is defined as the interval between the work place end date (WPED), when material is first declared to be waste, and the time that complete information on declared waste is placed into the TWMS database so that the data can be analyzed. Initial estimates of waste quantities by waste type are subject to considerable revision over subsequent months. Revised estimates arise because of initial under or over reporting of waste quantities as routine waste, misclassification of waste types, the time needed to obtain testing and certification results, and several other variables. Final values for Lawrence Livermore National Laboratory annual waste quantities are, in fact, not available until several months after the end of a given calendar year. This is due to the complexity of the waste management process which takes a significant amount of time to accurately sample, characterize, and certify the waste for final treatment, storage, and disposal. This is driven by the increasingly more stringent waste acceptance criteria of the treatment, storage, and disposal facilities.

At present, information about LLNL waste quantities for performance measures quarterly status reports is gathered 10 days after the end of the last month of the previous quarter. In contrast, the DOE annual report is based on a lag time of one quarter. When TWMS data are assessed soon after the end of a quarter, the incompleteness of reported data can be as much as $\pm 50\%$. This problem in the timeliness of data is not obvious to the interested parties that receive and review quarterly status reports. An analysis of total waste quantities for the past four calendar years shows that the data stabilize to a reasonable level of confidence after an elapsed time of 90 days. This document recommends a lag of one quarter (90 days) for the purpose of improving the accuracy of the quarterly reporting

Recommendations for Improving Waste-Generation Reporting for the Contract 48 Performance Measures

Introduction

Total Waste Management System Database

The Hazardous Waste Management Division (HWM) at Lawrence Livermore National Laboratory (LLNL) is responsible for managing the Total Waste Management System (TWMS) database. The TWMS database includes information on all low-level radioactive, low-level mixed, hazardous, and industrial wastes generated at LLNL. Wastes are categorized as routine versus nonroutine, by an LLNL defined source code.

Information in the TWMS database is analyzed by personnel in the Pollution Prevention Group (PPG), a group within the LLNL Environmental Protection Department, to prepare three kinds of reports. The first report is the *Environment, Safety, and Health Performance Measures Quarterly Status Report*, which is mandated by University of California/Department of Energy (UC/DOE) Contract 48. For this quarterly status report, performance measures data on LLNL process and solid waste generation quantities are prepared by the PPG. The results of the assessments are submitted to the ES&H Compliance Manager (Laboratory Site Operations), to the DOE Oakland Operations Office (DOE/OAK), and to the UC (Office of the President). The second reporting document is an annual self assessment completed by PPG during the summer for data gathered from the previous year. The recipients of this report are the same as those for the quarterly report. The third document is the DOE annual report, which is prepared during the March–April time frame for data gathered from the previous year.

Tracking and Assessment of Data

Data on process and solid waste generation, as well as waste recycling and diversion from landfills, are tracked by computer for all LLNL programs that are waste generators. The HWM tracks the location of wastes, enters information into the TWMS database, and maintains (updates) the database. On the tenth day of each month, the PPG obtains TWMS data from the previous month and reviews the information for trends with respect to like months in previous years. A major focus is also placed on accuracy of the reported data; that is, designations of routine versus nonroutine wastes, identification of the source code (3-digit identification number), and reported quantities as a function of the generator are reviewed and verified monthly. Questionable designations and quantities are flagged, and queries are sent to environmental analysts, the waste generators, and/or HWM personnel for review, reassessment, and revision of the TWMS database.

It is important to recognize that each month, quantities of waste are reported to PPG not only for the immediately preceding month, but also for months previous to that because waste quantities continue to be revised and adjusted as a function of updated information. Thus, information about waste quantities generated in January, for example, is first estimated and reported on February 10. However, the January estimate continues to be adjusted (either upward or downward) during subsequent months of the year, and the actual amount is not known with certainty until well after the year end. A similar argument applies for every other month of the year. Certainty regarding waste quantities is very much a function of elapsed time. Simply stated, incomplete data are available to PPG immediately, but more complete information on waste quantity is a matter of hindsight. This issue forms the basis for recommendations made in this document. The question is: for purposes of quarterly reporting, how much hindsight is needed to provide a reasonably accurate representation of the final waste quantities?

The final “grade” on performance measures that LLNL receives from both the UC and the DOE comes after the self assessment is completed and reviewed. Because the annual self assessment is completed in the summer (for data from the previous calendar year), the quarterly status reports themselves are not critical for performance measures grading. Thus, a significant amount of effort is expended every quarter using incomplete data to generate a nonessential and noncritical status report. LLNL often tries to extrapolate the first quarter’s data to estimate the anticipated annual waste generation. Such an approach only serves to magnify the inaccuracy of the report by a factor of 4.

Definitions

To evaluate the current tracking method and to provide recommendations for improved data accuracy for the purposes of quarterly status reporting, the following definitions are used:

- The **work place end date** (WPED) is defined as the time that waste containers are secured in the work place and placed into a waste-accumulation area. At this time, the generators have declared the material to be waste.
- The **elapsed time** is defined in this document as the interval between the WPED and the time that complete information on declared waste is placed into the TWMS database so that the data can be reviewed by PPG. The elapsed time can be brief or protracted due to analytical testing for characterization, certification requirements, the absence of regulatory deadlines for certain types of waste, and other considerations.

The elapsed time is the primary independent variable used in this document. An analysis of elapsed time is useful because it reveals a problem with the current quarterly reporting methodology. The issue centers on the time sensitivity of TWMS data. In particular, if the TWMS data are assessed and then formally reported on too early (i.e., if the elapsed time is too brief), then reported information will be based on an incomplete set of data which has to be revised in the next quarter. At present, data for the performance measure quarterly status reports are gathered 10 days after the end of the last month of the previous quarter. In contrast, the DOE annual report is based on a lag time of one quarter.

Data in the DOE annual report are “frozen” in the March–April time frame for reporting purposes. However, the LLNL self assessment that is prepared in the summer (for the previous year) contains a different data set if the data are downloaded from TWMS after the DOE annual report is prepared. Therefore, it is currently possible for LLNL to report two different waste-generation totals to the same reviewer (the DOE).

PPG therefore recommends that the data set that is frozen for the DOE annual report also be used for the performance measures self assessment. The PPG proposes to download the TWMS data on April 10–15 for the previous calendar year and to use these totals for the DOE annual report and the performance measures self assessment. It is also recommended that the quarterly reports be de-emphasized and not used to track performance because of the inherent incompleteness of the data, unless reports are prepared 90 days after the end of the reported quarter.

The next section, Results, identifies the deficiencies in the elapsed time currently used to generate quarterly status reports. Specific recommendations for optimized quarterly reporting intervals are provided at the end of this document.

Analysis and Results

The total quantity (mass) of reported LLNL TWMS waste for four calendar years, 1994 through 1997, forms the basis of this assessment. The key independent variable in the analysis is the elapsed time (days from the WPED to complete data entry available in the TWMS database). To facilitate interpretation of the data, results are expressed as the “cumulative percent of total waste” compared to the final total after it was known for the year. The cumulative percent of total is a running total of waste quantity over increasingly longer elapsed times. In essence, the cumulative percent is a measure of the completeness of TWMS data at any given elapsed time, compared to the final waste total known for the year.

TWMS data were also assessed by individual waste type. The analysis by type was performed because it can identify potential differences in the timeliness of reporting specific kinds of waste.

The data for previous calendar years used in the assessment were downloaded from TWMS in June, 1998. As this assessment will demonstrate, it is possible that all of the 1997 data may still not be completely entered in the TWMS database. In fact, when the data set was downloaded, there were more than 200 requisitions and items on hold. Waste may be brought into a permitted HWM storage facility under some circumstances pending receipt of full-scale analytical results (for example, waste that will exceed the 90-day storage limitations in the waste accumulation area while HWM is awaiting analytical results). This means that adequate information was still not available to complete the database entry. Thus, the 1997 data set should be viewed as incomplete.

Comparison of Total Waste Quantities by Calendar Year, 1994–1997

Table 1 shows the total quantities (cumulative percentages) of TWMS waste reported as a function of elapsed times from <0 to >360 days. Note that elapsed times do not necessarily correspond to any specific days of a calendar year, but to reporting intervals that can take place at different times in a year. Highlighted areas of the table show the elapsed times at which 90% or more of the total waste for a given year (a final value identified retrospectively) was available to PPG for assessment. Although the cumulative value of 90% is a somewhat arbitrary measure, it is a useful way to illustrate when a basic level of confidence has been achieved in the completeness of the data.

Note that two entries in Table 1 have an elapsed time of less than zero. Such a situation can occur when the HWM starts a requisition for a waste container in their facility before the container is filled and secured. Another possible cause is entry into the database of an inaccurate WPED.

Table 1. Cumulative percent of the total quantity of reported TWMS wastes available to PPG for assessment as a function of elapsed time for CY 1994–1997.

Elapsed time (days)	Calendar year 1994	Calendar year 1995	Calendar year 1996	Calendar year 1997
<0	0.0	0.8	3.0	0.9
30	42.6	61.8	66.9	82.8
60	70.7	79.8	80.2	92.2
90	83.5	86.6	88.9	94.2
120	88.0	89.3	91.4	96.7
150	90.7	90.7	93.8	97.4
180	92.4	90.9	95.0	97.9
210	92.5	91.1	96.1	98.1
240	92.6	91.9	97.0	98.2
270	92.6	92.0	98.0	98.4
300	92.7	92.1	98.9	98.4
330	92.7	92.1	99.0	99.1
360	92.8	92.6	99.5	99.5
>360	100	100	100	100

A principal conclusion from Table 1 is that, on average, an elapsed time of approximately 90 days is required to achieve reasonable confidence that the data are at least 90% complete. For calendar years 1994 and 1995, 90% of the data for any given month was not available until an elapsed time of 150 days. However, the timeliness of reporting relatively complete information to PPG appears to have improved during 1996 and 1997. In fact, significant improvements have been achieved in the overall data management process since 1994.

The lag time for quarterly reporting purposes is now only 10 days from the end of the previous month. As shown in Table 1, even if this lag time were extended to 30 days, the information available to and reported by PPG would remain relatively incomplete.

Comparison of Different Waste Types versus Elapsed Time

Another way to look at the problem is to review the TWMS data by waste type. Seven LLNL waste types were assessed in a manner similar to that shown in Table 1. These waste types are identified and defined in Table 2.

Table 2. Description of seven types of LLNL waste assessed in this report.

Percent of total waste ^a	Waste type	Description of waste
7.6%	F	Mixed waste: low-level radioactive waste with federally regulated hazardous constituents
44.8%	H	Hazardous waste
7.5%	L	Low-level radioactive waste that has been certified for shipment to NTS for disposal
34.0%	N	Nonhazardous waste
5.3%	R	Low-level radioactive waste
1.1%	S	Low-level radioactive waste that contains California-regulated hazardous waste ^b
0.2%	T	Transuranic waste

^aPercentages are calculated using CY 1994–97 median values.

^bThis waste is also now called “combined waste” because **California and DOE are negotiating its regulatory status.** Because it is not federally regulated under RCRA, it is not a federal mixed waste.

To summarize the results, Figure 1 shows the elapsed times at which at least 90% of the final quantity for each waste type was available to PPG for assessment. It is clear that the elapsed time necessary to obtain confidence in the data varies widely as a function of waste type. Several explanations help to account for this observation. The elapsed times are relatively short for hazardous (H) and nonhazardous (N) waste types. As shown in Table 2, these two types of waste made up 78.8% of the total LLNL wastes in the TWMS database for CY 1994–1997. Hazardous waste cannot be stored for more than one year, and nonhazardous waste is relatively easy to dispose of. In contrast the elapsed times are the longest for the L, S, and T waste types because that are radioactive. Radioactive waste treatment, storage, and disposal requirements are much more demanding than hazardous waste. The sampling, characterization, analysis, and certification processes are very detailed in order to meet the waste acceptance criteria of the treatment, storage, and disposal facilities. It should be noted that for the performance measure reports the level of detail is not as great as is it for certifying the waste. Basically, PPG needs to know the source code, waste description, a description of the process generating the waste and the quantity of the waste, in order to determine

if it was a routine or a non –routine waste. Non-routine waste generation is not reported for the performance measures. In the future PPG should work with HWM to reduce the time required for the data to be complete enough for the performance measures reporting.

Three of the seven waste types are characterized by relatively long elapsed times. This is a one of the factors that delays achieving a reasonable confidence level in the data quickly. The issue of what can be done to reduce the longest elapsed times should perhaps be addressed. However, even if this particular problem were resolved, it is important to note that the elapsed times for all seven waste types contribute to the problem of low confidence in the initial monthly data provided to PPG for quarterly status reporting.

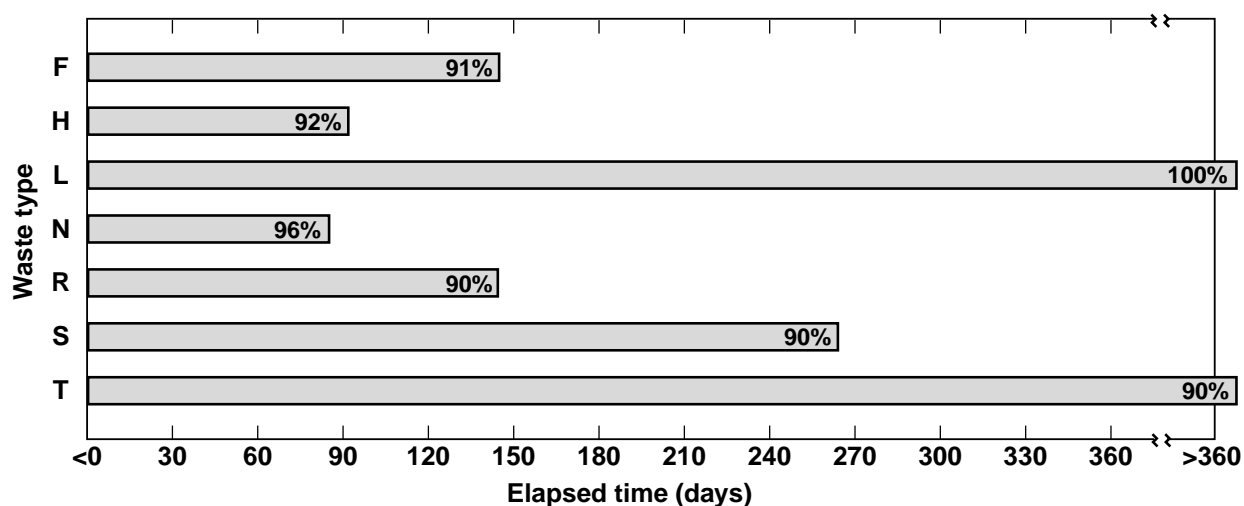


Figure 1. Summary of eight wastes types and elapsed times when at least 90% of final data were available to the PPG for assessment. Median values for CY 1994–1997 data are shown.

Summary of Data for All Waste Types for All Four Calendar Years

Figure 2 is a summary of data on total TWMS waste quantities using median values obtained over the last four calendar years. This figure plots the total quantities as the percent of annual waste generation, ascertained following year end, as a function of elapsed time. The extended vertical bar shows that 90% of the total waste amounts for all types of waste combined were available to PPG for assessment after an elapsed time of 120 days. However, nearly the same level of confidence is achieved at an elapsed time of 90 days. This is the principal basis for a recommendation that the lag time for quarterly status reporting be extended to at least 90 days.

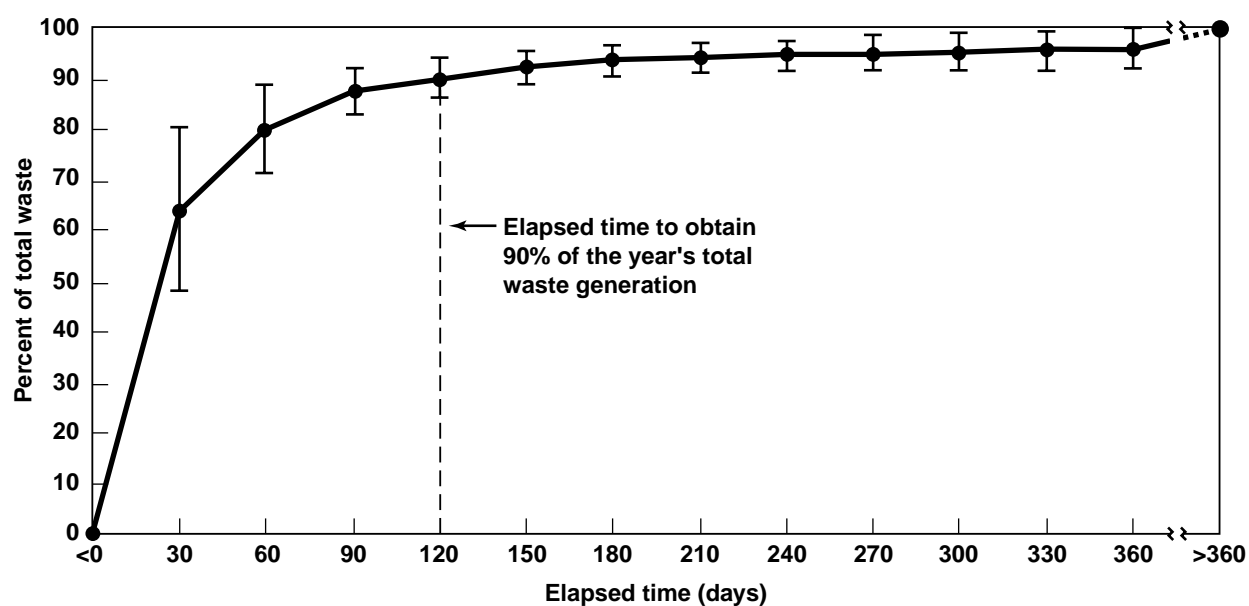


Figure 2. Summary of total TWMS waste quantities versus elapsed time for CY 1994–1997. Median values with standard deviations are shown.

Recommendations

The following recommendations are based on this assessment of reported TWMS data during calendar years 1994 through 1997:

Monthly Reviews

- Continue to collect and review TWMS data monthly.

Quarterly Reports

- Continue to report TWMS data quarterly. De-emphasize the significance of these quarterly reported data.
- Increase the lag time for quarterly reports from 10 days to 90 days to provide a higher level of confidence in the completeness of data. Thus, for example, the first-quarter data would be reported in July.

DOE Annual Reports

- Continue to report TWMS data during the March–April time frame for data gathered from the previous year. The lag time of 90 days is sufficient for this annual report.

Self Assessment

- Use the same data set for self assessment that is used for the DOE annual report.